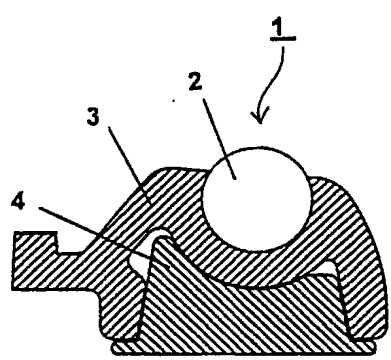
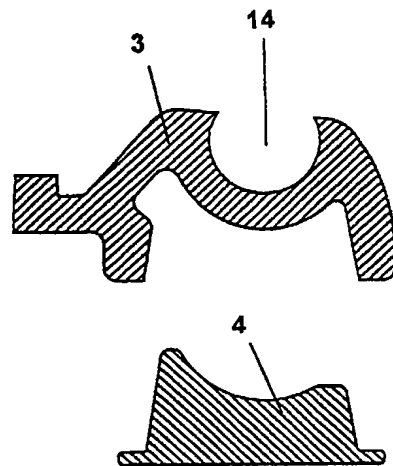




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(21) International Application Number: PCT/FI00/00318 (22) International Filing Date: 14 April 2000 (14.04.00) (30) Priority Data: 990885 20 April 1999 (20.04.99) FI (71) Applicant (for all designated States except US): VALMET CORPORATION [FI/FI]; Fabianinkatu 9 A, FIN-00130 Helsinki (FI). (72) Inventors; and (75) Inventors/Applicants (for US only): LINTULA, Timo [FI/FI]; Lintusyrjäntie 64, FIN-42700 Keuruu (FI). KIRJAVA, Jouni [FI/FI]; Jussilantie 18, FIN-36110 Ruutana (FI). (74) Agent: FORSSÉN & SALOMAA OY; Yrjönkatu 30, FIN-00100 Helsinki (FI).		(81) Designated States: AE, AG, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), DM, DZ, EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> <i>In English translation (filed in Finnish).</i>
(54) Title: COATING DEVICE <div style="text-align: center;">  <p style="text-align: center;">A</p>  <p style="text-align: center;">B</p> </div> (57) Abstract <p>The invention relates to a coating device for a paper or board machine comprising a coating rod (2), by means of which a coating is applied onto a base to be coated, such as paper or board or a roll of a film size press and which coating rod (2) can be loaded, and a rod bed (1) on which the coating rod (2) is supported substantially over its entire length and arranged to rotate in its rod space (14). The rod bed (1) comprises a structure which has at least two parts which have been disposed in a longitudinal direction one within the other or partly one within the other. The invention also relates to a rod bed and to a method of fitting a coating rod in connection with a coating device of a paper machine and to a method of changing a coating rod.</p>		

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Coating device

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The invention relates to a coating device for a paper or board machine comprising a coating rod, by means of which a coating is applied onto a base to be coated, such as paper or board or a roll of a film size press, and a rod bed on which a coating rod is supported substantially over its entire length and arranged to rotate in its rod space. The invention also relates to a rod bed as well as to a method of fitting a coating rod in connection with a coating device of a paper machine and to a method of changing a coating rod.

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In paper and board machines, rod coating devices are used for coating and/or surface sizing paper, board or a moving base with a desired coating material. The coating device comprises a rotating coating rod lying against a moving base and extending across the width of the machine, which coating rod is supported on a rod bed substantially over its entire length and which coating rod is arranged to spread and smooth onto the moving base a coating material passed into the coating device before the coating rod in the running direction of the moving base. The rod bed is in most cases a one-piece casting which is made of polyurethane and which is dimensioned for a coating rod of a given size and type. The dimensioning of the coating rod depends on the paper grade that is manufactured, on a paper machine, and usually every rod type and rod size has its own rod bed. Thus, when it is desired to change the rod size, the rod bed must also be changed.

30

FI patent 85 398 describes a coating rod bed formed of several identical parts, in which the length of each part constitutes only a small part of the entire width of the machine. The parts have been joined successively to one another in the direction of the machine width by means of a suitable joint to form a continuous bed. However, the bed formed of pieces must always be changed when the size of the rod is changed.

A drawback of polyurethane used in the manufacture of rod beds is its higher friction coefficient as compared with some thermoplastics as well as its tendency to absorb water in moist conditions and at elevated temperatures. The absorption of water causes softening of the material and decrease in its wear resistance as well as deterioration in its other mechanical properties. Wear of the rod bed causes an increase in the clearance between the bed and the rod, in which connection coating slip, surface size or even fibre material may accumulate in the bed, in the worst case causing the rod bed or the rod to be locally worn into grooves, the rod to be detached from its bed, or the roll cover to be damaged. When the rod bed is broken or becomes worn, it must usually be replaced altogether, which causes high costs. Attempts have been made to increase the wear resistance of rod beds by means of improvements in material so that the bed has been made of a harder material than normal, but in that connection the fitting of the rod in the bed becomes a problem. When the rod is fitted in a very hard bed, there is a risk that both the bed and the rod are broken. Based on the above, there is a clear need for a coating device of a paper or board machine which comprises a rod bed that is more durable, less expensive and easier to handle.

An object of the invention is to provide a coating device of a paper or board machine which comprises a coating rod by means of which a coating is applied onto a base to be coated, such as paper or board or a roll of a film size press and which coating rod can be loaded, and a rod bed on which the coating rod is supported substantially over its entire length and arranged to rotate in its rod space.

An object of the invention is also to provide a rod bed.

Further, an object of the invention is to provide a method for manufacturing a rod bed for use in a coating device of a paper machine, a method for fitting a coating rod of a coating device of a paper machine in connection with the coating device of the paper machine, and a method for changing a coating rod in a coating device of a paper machine.

The coating device, the rod bed, the method of manufacturing a rod bed, the method of fitting a coating rod, and the method of changing a coating rod are characterized in what is stated in the claims.

- 5 It has been found that the problems of the known state of the art can be solved and they can be substantially reduced by means of a coating device in which a rod bed comprises a structure which includes at least two parts which have been disposed in a longitudinal direction one within the other or partly one within the other. The invention will be illustrated by means of the following figures showing some
10 advantageous embodiments to which the invention is not intended to be limited.

List of figures

Figure 1: A sectional view of a rod coater seen from the side.

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Figure 2: Sectional views of rod beds according to prior art seen from the side.

Figure 3: A rod bed of a coating device according to the invention, which rod bed is adjustable in its fit and which comprises at least two parts.

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Figure 4: A rod bed of a coating device according to the invention, which rod bed comprises at least two parts, one of them being a changeable fitting piece for rods having different diameters.

- 25 Fig. 1 shows a surface sizing or coating device 100 of a paper or board machine. The coating device 100 is a rod coating device, the coating rod 2 of which in the prior art arrangement of Fig. 1 has been disposed against a paper or board web W travelling on the surface of a back-up roll 10. Coating material is passed into a coating material chamber 20 situated, in the running direction of the back-up roll 10
30 or the web W, before the coating rod 2 provided in a rod bed 1, which coating material chamber is defined, in addition to the coating rod 2, by the back-up roll 10 or the web W, a front wall of the coating material chamber or a sealing blade 30,

and edge seals, which are not shown in the figure. The figure also shows a feed tube 40 and an edge doctor 50.

Fig. 2 shows three rod beds 1a, 1b, and 1c according to prior art, which each
5 comprise only one part such that each rod bed is intended to be used only with a rod 2a, 2b, and 2c having a given diameter.

Fig. 3 shows a rod bed 1 of a coating device according to the invention, which rod
bed is adjustable in its fit and which comprises a frame part 3 of the bed, which can
10 be mounted on frame structures 11 of the coating device, such as a support structure of the rod bed, and which frame part 3 comprises a space 14 for a coating rod 2 as well as a wedge part 4 by means of which the frame part 3 is clamped to keep the coating rod 2 in its position. The frame part 3 may also comprise a separate change-
able inner part for rods with different diameters. The clamping of the rod bed can
15 be regulated by means of the wedge part 4 and the wedge part 4 allows the rod bed to be profiled by means of a profiling device. It is possible to integrate with the wedge part 4 a loading member 6, such as a loading hose or several loading hoses, operating, for example, hydraulically, pneumatically or mechanically, for example, by means of a crank, cam, or eccentric mechanism. The loading mechanism, as the
20 loading hose shown in the figure, may be situated in connection with the frame part of the coating device, as in Fig. 3D, or it may also be placed in grooves 5 of the wedge part 4, as in Fig. 3C.

Fig. 4 shows a rod bed 1 of a coater according to the invention, said rod bed
25 comprising a frame part 3 of the bed, which can be mounted on frame structures 11 of the coating device, such as a support structure of the rod bed, and which frame part 3 comprises a space 15 for a fitting piece 8i as well as an optional wedge part 4, by means of which the frame part 3 and the fitting piece 8i are clamped in order to keep a coating rod 2i in its position. The fitting piece 8i includes a space 14 for
30 the coating rod 2i. Each rod 2i having a different diameter has its own changeable fitting piece 8i. In the fitting piece, in connection with the frame part 3 or the wedge part 4, it also is possible to place at least one loading member 6, such as a com-

pressed air hose, advantageously in grooves 9 for regulation of the clamping of the fit and/or the frame part and for compensation of wear.

5 The coating device of a paper or board machine in accordance with the invention comprises a coating rod by means of which a coating is applied onto a base to be coated, such as paper or board or a roll of a film size press, and which coating rod can be loaded, and a rod bed on which the coating rod is supported substantially over its entire length and arranged to rotate in its rod space, and the rod bed comprises a structure which includes at least two parts which have been disposed in
10 a longitudinal direction one within the other or partly one within the other and, in addition, the parts of the rod bed have been fitted detachably to each other.

The rod bed of the coating device comprises a frame part which can be mounted on frame structures of the coating device, such as a support structure of the rod bed,
15 and which frame part comprises a space for the coating rod or for a fitting piece. The rod bed additionally includes at least either a fitting piece comprising a space for the coating rod or a wedge part for clamping the frame part or the frame part and the fitting piece in order to keep the coating rod in its position. Either the frame part or the wedge part or both are attached to the frame structures of the coating
20 device.

The coating device may also comprise loading members in connection with the wedge part or the frame part of the fitting piece of the rod bed. When the rod bed comprises a frame part and a wedge part as well as loading members placed in
25 connection with the wedge part, it is advantageous to place the loading members in grooves provided in the wedge part. In the case where the rod bed comprises a frame part and loading members placed in connection with the frame part of the fitting piece, it is advantageous to place them in grooves situated in the frame part. The rod bed may also comprise a frame part and a fitting piece as well as loading
30 members in the fitting piece.

By means of the movement of the loading member, such as the pressure of a loading hose, it is possible to regulate the clamping of the bed, to compensate for its wear and to improve the cleanness of the rod by maintaining the doctoring effect of an upper lip of the bed during running and to keep the rod bed in optimum clamping.

- 5 If the loading hose is located in the grooves of the wedge part, a steel profile rib usually made by planing, serving as a back-up part, becomes simpler. The loading hose can be protected better from the process surroundings when it is situated in the groove of the wedge part. When needed, a loading member can be additionally fitted beneath the wedge part such that the lip of the frame bed can be bent, thereby
10 further improving the doctoring effect of the lips of the bed. The loading members can be changed as a package, when needed.

- The rod bed is manufactured such that at least two parts are manufactured separately, the shape of the parts being such that their longitudinal side or sides can be
15 disposed together one within the other or partly one within the other, and the parts are fitted together to form an integrated rod bed.

- At least one part, preferably all parts of the rod bed are made of thermoplastic or thermosetting plastic, possibly as fibre-reinforced. Advantageously, at least one part
20 or possibly all parts of the rod bed are made by extrusion or pultrusion out of a plastic material or of a fibre-reinforced plastic material. The part can be manufactured to a desired profile shape by means of extrusion or pultrusion. The desired shape for the casting can be provided by machining.

- 25 For the material of the frame part can be chosen a material that has a low friction coefficient, which material is also advantageous from the standpoint of it remaining clean. The frame part can be made of polyurethane, thermoplastic, such as polyethylene, wear-resistant low-friction thermosetting plastic or a plastic composite which may contain staple fibres and/or continuous reinforcing fibres and a filler.
30 Extrusion and pultrusion methods are particularly suitable for the manufacture of the frame part. The advantages of these methods include economy as compared with other methods, such as machining, and simplicity; in addition, long components can

be manufactured out of several different material alternatives. The frame part is preferably shaped such that it is advantageous from the standpoint of extrusion and does not comprise any major cross-sectional thickness variations because material concentrations may cause problems because of cooling rate differences and internal stresses.

The wedge part can be manufactured by a pultrusion method, whereby desired axial properties are obtained and the wedge part may also be made hollow. The wedge part is advantageously made of thermosetting plastic, such as epoxy or vinyl ester and glass-fibre reinforcement, or of thermoplastic as fibre-reinforced or filled by means of an extrusion method. A good combination of properties can be achieved for the bed by means of a wedge part having good strength properties and a frame part having favourable friction properties, and the fit of the rod bed can be regulated so as to be of desired magnitude by modifying the wedge part.

The wedge part carries part of the load, so the strength properties of the frame part may be lower. The wedge part need not usually be changed. The wedge part can also be optionally modified in the cross direction of the machine, for example, by means of bevels or by making the rod thinner at its ends, thereby allowing a lighter rod load to be provided at the edges of the bed. The bed is clamped around the rod by means of the wedge part, and the wedge part allows the rod bed to be well profiled by means of a profiling device. In order to enhance the profiling in the cross direction, the wedge part can be made of segments or of parts coupled to one another with sawed portions or with connecting portions, or of equivalent parts with cross-direction relief portions, in which connection the profiling effect can be directed at a desired area. In a structure containing reinforcing fibres, a better profiling capability can be achieved by orienting the fibres such that the wedge piece is less stiff in a cross direction than in a longitudinal direction.

The fitting piece may comprise polyurethane, thermoplastic, such as polyethylene, wear-resistant low-friction thermosetting plastic or a plastic composite. The material of the fitting piece may contain fillers and staple fibres and/or continuous fibres as

reinforcements, which impart desired strength and friction properties to it. The friction coefficient of the plastic or composite selected for the fitting piece is preferably lower than that of urethane, so that the need for torque is also lower. A preferred method of manufacturing the fitting piece is pultrusion or extrusion. The rods can be delivered as pre-fitted and packed in their fitting pieces, in which connection the fit between the rod and the rod space can be checked before delivery. Thus, the fitting piece can be utilized as a package and it protects the rod during storage and transport from a factory to a paper machine. The arrangement is also economical because the changeable fitting piece of the bed can be manufactured as yard goods. In that connection, it is possible to continuously use the same frame part in which a bed is imbedded which is separate for each rod. This allows very economical arrangements to be achieved, thereby obtaining clear savings, and material combinations may be selected as needed.

The coating rod of the coating device in a paper machine can be fitted in connection with the coating device of the paper machine such that the coating rod is disposed in place in the rod space of the frame part, and the frame part and the wedge part are fitted in connection with the frame structures of the coating device. It is easy to fit the rod in the bed because the frame part bends open with a small force and the fit of the rod space of the frame part can be adjusted by changing the angle and depth of the wedge piece as desired. In that connection, the diameter of the rod can vary and the need for the torque of rotation of the rod does not rise too high.

When the fitting piece is used, the coating rod can be fitted in connection with the coating device of the paper machine such that the coating rod is first disposed in the rod space of the fitting piece of the rod bed, then the fitting piece is disposed in connection with the frame part, and after that the frame part or the frame part and the wedge part are fitted in connection with the frame structures of the coating device.

The coating rod of the coating device in the paper machine can be changed such that a rod bed is used which comprises at least a frame part mounted on the frame

structures of the coating device and a fitting piece detachably disposed within the frame part, the coating rod being disposed in connection with the fitting piece; the fitting piece is removed from the frame part; a new fitting piece is placed in connection with the frame part, a coating rod having a desired diameter having been
5 disposed in said new fitting piece.

Claims

1. A coating device for a paper or board machine comprising a coating rod (2), by means of which a coating is applied onto a base to be coated, such as paper or board or a roll of a film size press and which coating rod (2) can be loaded, and a rod bed (1) on which the coating rod (2) is supported substantially over its entire length and arranged to rotate in its rod space (14), **characterized** in that the rod bed (1) comprises a structure which has at least two parts which have been disposed in a longitudinal direction one within the other or partly one within the other.
2. A coating device according to claim 1, **characterized** in that the parts of the rod bed (1) are fitted detachably to each other.
3. A coating device according to claim 1 or 2, **characterized** in that the rod bed (1) comprises
- a frame part (3) which can be mounted on frame structures (11) of the coating device, which frame part (3) comprises a space (14) for the coating rod (2) or a space (15) for a fitting piece (8) and additionally at least one of the following
 - a fitting piece (8) comprising a space (14) for the coating rod (2),
 - a wedge part (4) by means of which the frame part (3) or the frame part (3) and the fitting piece (8) are clamped to keep the coating rod (2) in its position.
4. A coating device according to any one of claims 1 to 3, **characterized** in that the rod bed comprises a wedge part (4) the shape and/or stiffness properties of which have been selected such that the rod bed can be profiled in the cross direction of the machine by means of the wedge part (4).
5. A coating device according to claim 3 or 4, **characterized** in that the coating device comprises loading members (6) in connection with one of the parts (3, 4, 8) of the rod bed (1).

6. A coating device according to claim 5, **characterized** in that the rod bed (1) comprises a frame part (3) and a wedge part (4) and that the loading members (6) are placed in connection with the wedge part (4), advantageously in grooves (5) of the wedge part (4).

5

7. A coating device according to claim 5, **characterized** in that the rod bed (1) comprises a frame part (3) and a fitting piece (8) and that the loading members (6) are placed in connection with the frame part (3), advantageously in grooves situated in the frame part (3).

10

8. A coating device according to claim 5, **characterized** in that the rod bed (1) comprises a frame part (3) and a fitting piece (8) as well as loading members (6) in the fitting piece.

15

9. A coating device according to claim 1 to 8, **characterized** in that at least one, preferably all of the parts of the rod bed (1) are made of thermoplastic or thermosetting plastic, possibly as fibre-reinforced or filled.

20

10. A rod bed (1) for use in a coating/surface sizing device of a paper or board machine, on which rod bed a coating rod (2) is supported substantially over its entire length and arranged to rotate in its rod space (14), **characterized** in that the rod bed (1) comprises a structure which has at least two parts which have been disposed in a longitudinal direction one within the other or partly one within the other.

25

11. A rod bed according to claim 10, **characterized** in that the parts of the rod bed (1) are fitted detachably to each other.

12. A rod bed according to claim 10 or 11, **characterized** in that the rod bed (1) comprises

30

- a frame part (3) which can be mounted on frame structures (11) of the coating device and which frame part (3) comprises a space (14) for the

coating rod (2) or a space (15) for a fitting piece (8) and additionally at least one of the following

- a fitting piece (8) comprising a space (14) for the coating rod (2),
- a wedge part (4) by means of which the frame part (3) or the frame part (3) and the fitting piece (8) are clamped to keep the coating rod (2) in its position.

13. A rod bed according to any one of claims 10 to 12, **characterized** in that the rod bed comprises a wedge part (4) the shape and/or stiffness properties of which have been selected such that the rod bed can be profiled in the cross direction of the machine by means of the wedge part (4).

14. A rod bed according to claim 12 or 13, **characterized** in that loading members (6) are disposed in connection with one of the parts (3, 4, 8) of the rod bed (1).

15. A rod bed according to claim 14, **characterized** in that the rod bed (1) comprises a frame part (3) and a wedge part (4) and that the loading members (6) are placed in connection with the wedge part (4), advantageously in grooves (5) of the wedge part (4).

16. A rod bed according to claim 14, **characterized** in that the rod bed (1) comprises a frame part (3) and a fitting piece (8) and that the loading members (6) are placed in connection with the frame part (3), advantageously in grooves situated in the frame part (3).

17. A rod bed according to claim 14, **characterized** in that the rod bed (1) comprises a frame part (3) and a fitting piece (8) and loading members (6) in the fitting piece.

18. A rod bed according to claim 10 to 17, **characterized** in that at least one, preferably all of the parts of the rod bed (1) are made of thermoplastic or thermosetting plastic, possibly as fibre-reinforced or filled.

19. A method of manufacturing a rod bed (1) for use in a coating device of a paper machine, **characterized** in that at least two parts are manufactured separately, the shape of said parts being such that their longitudinal side or sides can be disposed together one within the other or partly one within the other, and the parts are fitted
5 together to form an integrated rod bed (1).

20. A method according to claim 19, **characterized** in that at least one part, preferably all parts of the rod bed (1) are made of a plastic material or of a fibre-reinforced and/or filled plastic material, advantageously by extrusion or pultrusion.
10

21. A method according to claim 19 or 20, **characterized** in that a wedge part (4) of the rod bed is manufactured and/or shaped such that the rod bed (1) can be profiled in the cross direction of the machine by means of the wedge part.

15 22. A method of fitting a coating rod of a coating device in a paper machine in connection with the coating device of the paper machine, **characterized** in that
A. the coating rod is disposed in place in a rod space (14) of a frame part (3),
and
B. the frame part (3) and a wedge part (4) are fitted in connection with frame
20 structures (11) of the coating device.

23. A method of fitting a coating rod of a coating device in a paper machine in connection with the coating device of the paper machine, **characterized** in that
A. the coating rod (2) is disposed in a rod space (14) of a fitting piece (8) of a
25 rod bed (1),
B. the fitting piece (8) is disposed in connection with a frame part (3),
C. the frame part (3) or the frame part (3) and a wedge part (4) are fitted in connection with frame structures (11) of the coating device.

30 24. A method of changing a coating rod in a coating device of a paper machine, **characterized** in that in a rod bed (1) which comprises at least a frame part (3) which has been fitted on frame structures (11) of the coating device and a fitting

piece (8i) which has been fitted detachably within the frame part (3) and in connection with which the coating rod (2i) has been disposed, the fitting piece (8i) is removed from the frame part (3) and a new fitting piece (8i) is placed in connection with the frame part (3), a coating rod (2i) having a desired diameter having been
5 disposed in said fitting piece.

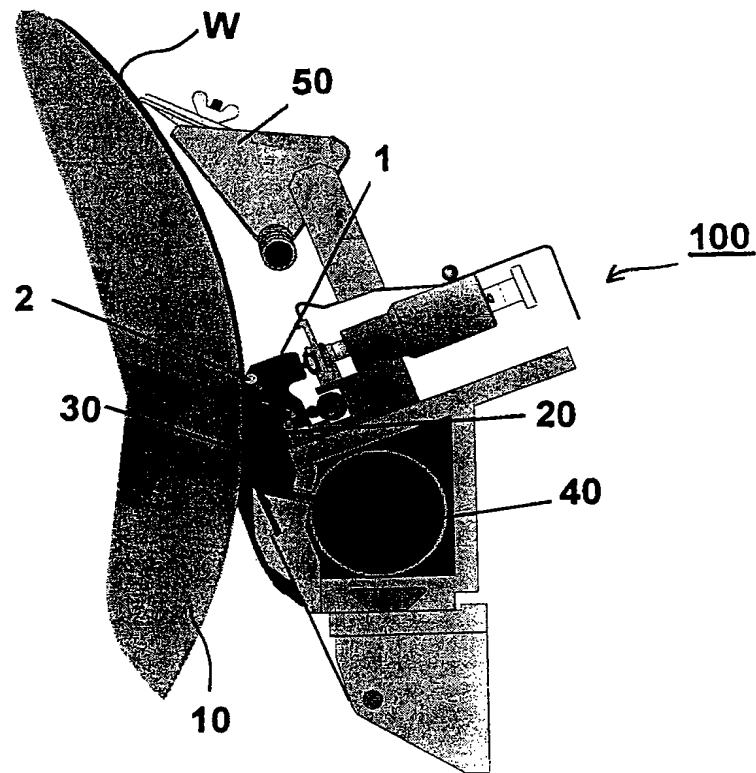


FIG. 1

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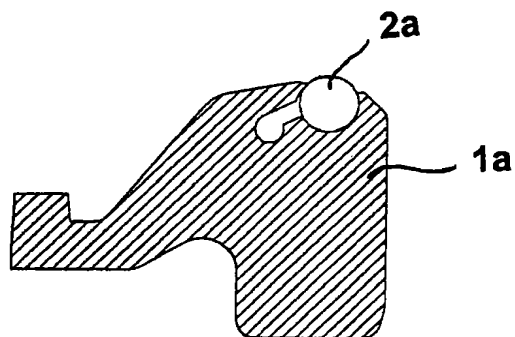


FIG. 2A

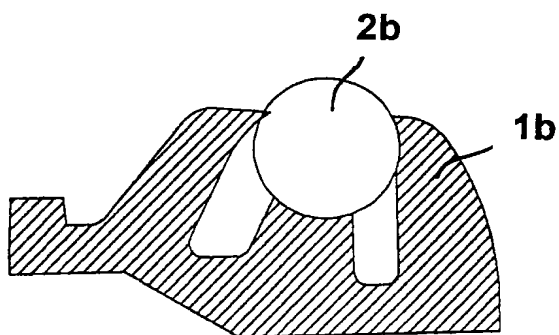


FIG. 2B

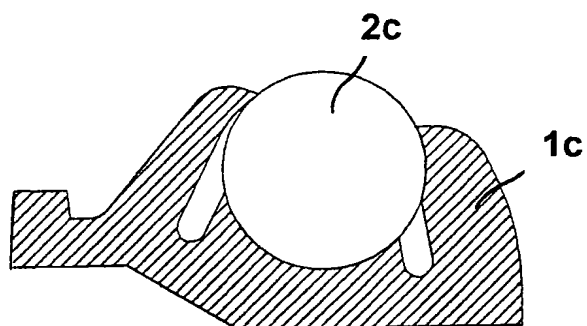


FIG. 2C

3/4

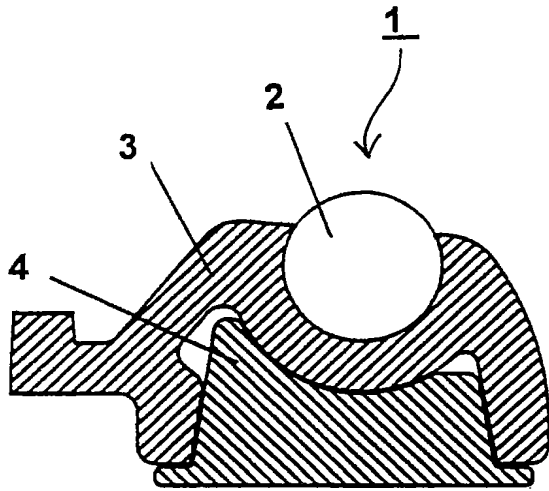


FIG. 3A

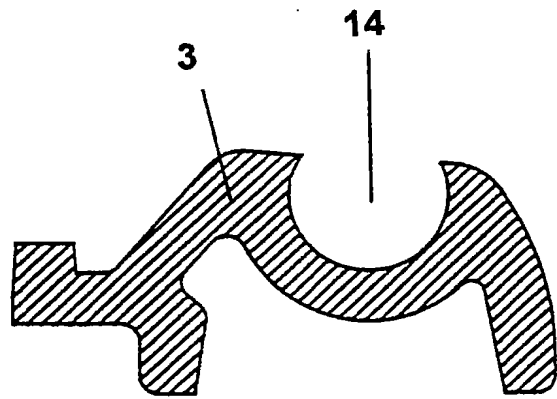


FIG. 3B

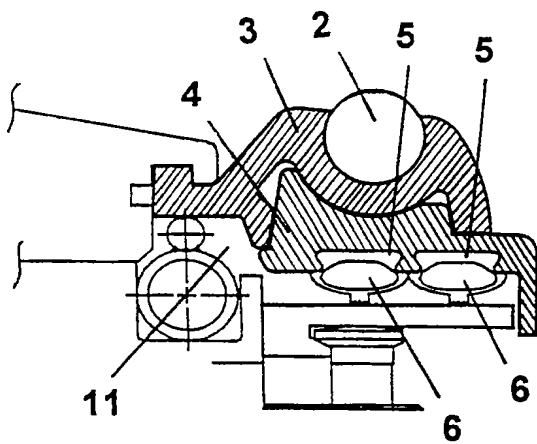


FIG. 3C

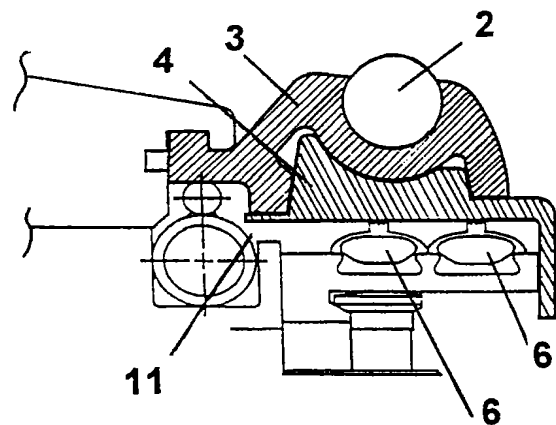


FIG. 3D

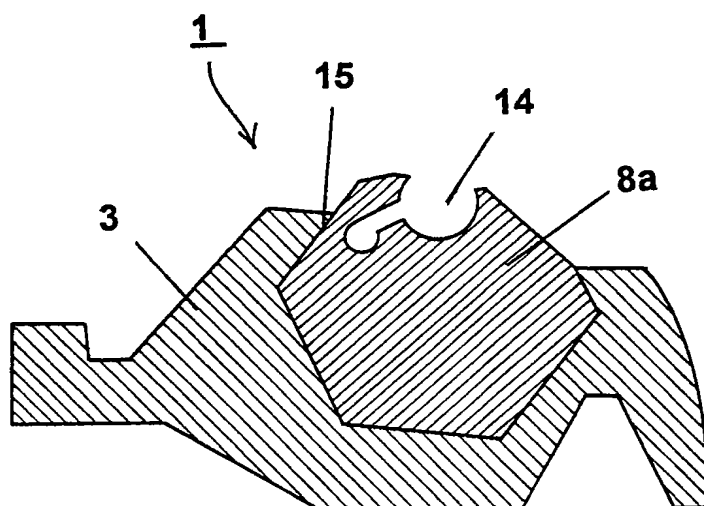


FIG. 4A

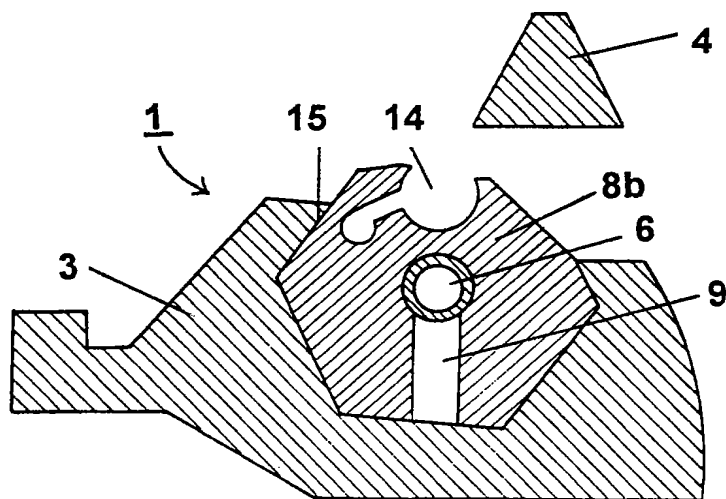


FIG. 4B

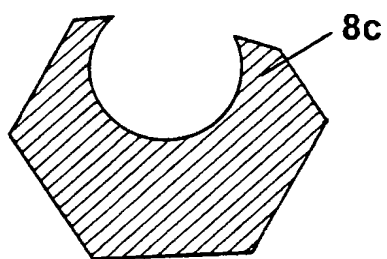


FIG. 4C

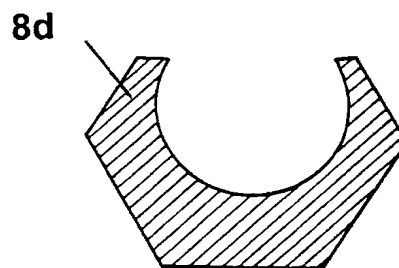


FIG. 4D

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00318

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21H 25/12, B05C 11/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: D21H, B05C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4367691 A (E.BERGS), 11 January 1983 (11.01.83), see column 2 --	1-14,17-24
X	US 4282826 A (G.WOHLFEIL), 11 August 1981 (11.08.81), column 1, line 23 - column 2, line 4 --	1-14,17-24
X	DE 19602483 C1 (HOFFMANN,EITLE), 5 June 1997 (05.06.97), see column 6 --	1-14,17-24
A	US 3817208 A (W.BARNSCHEIDT ET AL), 18 June 1974 (18.06.74), column 2, line 49 - column 5, line 4 -- -----	1-24

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

16 August 2000

Date of mailing of the international search report

29-08-2000

Name and mailing address of the ISA/
Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM
Facsimile No. +46 8 666 02 86

Authorized officer

Barbro Nilsson /itw
Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

International application No.

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